MA 125 - 6B,   CALCULUS I
September 26, 2012

Name (Print last name first): ....

 Student Signature: ....

$$\boxed{\boxed{\text{TEST II}}}$$

$$\boxed{\text{No calculators are allowed!}}$$

$$\boxed{\text{PART I}}$$

Part I consists of 10 questions. Clearly write your answer in the space provided after each question. Show your work as much as possible.

Each question in Part I is worth 5 points.

<u>Question 1</u>. Differentiate the function $f(x) = x^2 - 5x + 12$.

Answer: ....

<u>Question 2</u>. Differentiate the function $f(x) = \sqrt{x} - 2\tan x$.

Answer: ....

Question 3 Find $f'(x)$ if $f(x) = x^5 \cos(x)$.

Answer: ....

Question 4   Differentiate the function $f(x) = \frac{x+1}{x-1}$. **Simplify your answer!**

Answer: ....

Question 5 Differentiate the function $f(x) = \sin(x^2 + 3)$.

Answer: ....

Question 6 Find the second derivative $y'' = \frac{d^2y}{dx^2}$ of the function $y = x^2 - \sin x$.

Answer: ....

Question 7 Let $V = \frac{4}{3}\pi r^3$ be the volume of a round ball of radius r.
Find $\frac{dV}{dt}$ when $r = 1$ and $\frac{dr}{dt} = 2$.

Answer: ....

Question 8 Find all values x in the domain of the function $f(x) = (x^2 - 1)^2$ where the tangent line at the point $(x, f(x))$ is horizontal.

Answer: ....

Question 9 Differentiate the function $y = \sin(\cos(x^2))$.

Answer: ....

Question 10 If $S(t) = 6t - t^2$ is the position of a particle at time t, find the velocity at time $t = 5$.

Answer: ....

PART II

Each problem is worth 10 points.

Part II consists of 5 problems. You must show your work on this part of the test to get full credit. Displaying only the final answer (even if correct) without the relevant steps will not get full credit.

Problem 1

Find the equation of the tangent line to the graph of the function $y = \sin x$ at the point with $x = \pi$. (It might help if you sketch the graph.)
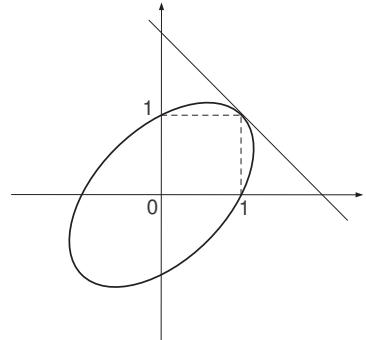
Problem 2

Find the derivative $y' = \frac{dy}{dx}$ of the implicit function $x^4 - y^4 = xy$.

Problem 3

Find the equation of the tangent line to the graph of the implicit function

$$x^2 - xy + y^2 = 1$$

at the point $(1,1)$. **You may use the illustration to check your answer, but provide all the calculations!**

Problem 4

A plane passes right over a radar station at an altitude of 1 mile with a speed of 100mph. How fast is the distance to the radar station increasing one hour later? (Your answer may contain a square root of a number.)
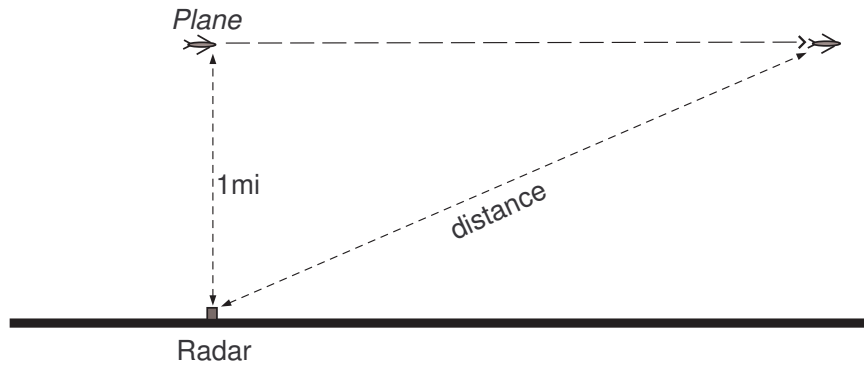
Bonus question: is the above rate of increase of the distance higher than 100mph or lower than 100mph? Explain.

Problem 5

Water is leaking out of an inverted conical tank at a rate of 2 cubic meters per hour. The tank has height 20 m and the diameter at the top is 10 m. How fast is the level of water in the tank dropping when it is 10 m high?

The volume V of a conical tank of height h and radius r is $V = \frac{1}{3}\pi r^2 h$.